Chemical & Engineering NEWS
February 18, 1980

U.S. chemical earnings up, but softness ahead. Page 9

West German chemical companies' unique research commitment Page 15

05111790090 9 X AR5807SL 1
CONGRESSIONAL INFO SERV
SRI ACQUISITIONS
7101 WISCONSIN AVE
WASHINGTON DC 20014

February 18, 1980
Volume 58, Number 7
CENEAR 58 (7) 1–120
ISSN 0009-2347

Cover: Photo courtesy of BASF

Chemical & Engineering NEWS

2 Letters
3 Editor's Page

Concentrates
7 Business
22 Government
27 Science/Technology

The Departments
107 ACS News
120 Newscripts

News of the Week

- ***Administration's nuclear waste management*** *program focuses on disposal sites, sets up state planning council.* ***Page 4***
- ***District court judge*** *orders EPA to begin testing 18 potentially hazardous chemicals as required under TSCA.* ***Page 5***
- ***Yale University will rent lab space*** *to Miles Laboratories for research on preclinical pharmacology.* ***Page 5***
- ***Salary differences*** *of women and minority-group scientists vs. white males in the federal work force are decreasing.* ***Page 5***
- ***Chemical companies are big contributors*** *to total corporate philanthropy, which reached the $2 billion mark in 1978.* ***Page 6***
- ***Synfuels program*** *could cause a shortage of engineering personnel, supplies.* ***Page 6***

Business

- ***Top 40 U.S. chemical firms*** *averaged 21% earnings gain in fourth-quarter 1979—below year ago but over predictions.* ***Page 8***

International

- ***West German chemical makers strong on R&D,*** *cultivate interaction among industry and universities.* ***Page 15***

Government

- ***OSHA chief Eula Bingham,*** *undaunted by stormy tenure, cites successes, is optimistic about agency's future.* ***Page 23***
- ***Controversy over sweetener aspartame*** *remains unresolved as FDA's first public board of inquiry ends.* ***Page 25***
- ***Data bank*** *available for* Federal Register *is new aid for those who track chemicals through government maze.* ***Page 26***

Science

- ***Synthesis of leukotriene C*** *will facilitate laboratory study of the biologically potent, asthma-related molecule.* ***Page 28***
- ***Enthusiasm of participants*** *in industry/academe conference held last year prompts scheduling of followup meeting.* ***Page 30***

Technology

- ***Fermilab's Tevatron accelerator*** *will double current energy peak, set the pace for large-scale superconductivity systems.* ***Page 31***

News Feature

- ***Federal guidelines*** *proposed to protect against reproductive hazards in workplace raise conflicting responses.* ***Page 35***

Books

- ***"The Politics of Peril"*** *warns western scientists—join concern for persons and society to reason or face nuclear war.* ***Page 39***

Final Program

- ***Complete technical and general programs*** *for the Houston ACS meeting.* ***Page 42***

Earnings gain off, but better than expected

Increase in chemical earnings slipped to 21% in fourth quarter after four quarters of larger gains; full-year earnings spurted 29%

William J. Storck
and William F. Fallwell
C&EN, New York

The fourth quarter of 1979 turned out much better for chemical companies than many in the industry thought it would. Earlier predictions by analysts had put earnings gains from fourth-quarter 1978 at anywhere from flat to 10%.

In fact, the increase for 35 of the top 40 U.S. chemical companies averaged 21% for earnings and 23% for sales.

The earnings gain for the chemical companies proves the cliché, "It depends upon your point of view." As recently as a year and a half ago, a 21% gain in earnings performance would have been viewed as very good news. Then in the fourth quarter of 1978, chemical earnings took off. They increased an average of 36% in the fourth quarter of 1978, and in the first three quarters of 1979 they increased 36%, 34%, and 30%. So now, the 21% gain in the fourth quarter must be viewed as bad news, representing a considerable slowing in the chemical economy.

For the full year, the news was good. As C&EN predicted earlier (C&EN, Nov. 12, 1979, page 10), sales for the industry for all of 1979 increased 22%. Earnings rose 29%, one percentage point higher than C&EN forecast. The greater increase in earnings over sales raised chemical profit margins from an average of 6.0% in 1978 to 6.6% in 1979. This is the highest full-year profit margin since 1976, when it was 6.7%.

However, as it was in the third quarter, the average profit margin is being held up by the smaller, less diversified companies, such as Freeport Minerals, Texasgulf, Nalco Chemical, and Big Three Industries.

In general, fourth-quarter earnings held up fairly well. But they were affected considerably by some big nonrecurring items at some of the larger companies. For instance, Dow Chemical had a nonrecurring gain of 28 cents a share. The elimination of this gain lowered the company's earnings increase for the fourth quarter from 41% to 4%.

However, there was a definite weakness in some parts of the chemical companies' markets in the fourth quarter. Most notable among the weak markets was fibers, dragging down earnings and profit margins at some companies. At Du Pont, fibers sales were almost $1.1 billion, a 21% increase in the fourth quarter over the same period in 1978. But income from fibers fell 16.5% to $69.2 million. At Allied Chemical, operating profits from its fibers and plastics division fell 16% from a year ago. Fibers earnings at Celanese dropped 57% from a year ago, and the company lost 12 cents a share on U.S. polyester and nylon. In fact, cellulosics were the only fibers to show an increase at Celanese; they were up 45%. And at Akzona, net after-tax operating income at its American Enka operation decreased 18% to $5.3 million in the fourth quarter.

However, probably the worst case was at Monsanto, where the company had a net loss in its fibers operations of $44.7 million, compared to a loss of $19.8 million in fourth-quarter 1978. In all of 1979, Monsanto lost more than $168 million in its textile operations. In 1978, these same operations lost $29.2 million.

And that was not all of the bad news at Monsanto. The firm's plastics and resins operations also showed a big loss in the fourth quarter—in this case $28.2 million. In fourth-quarter 1978 the same business had a modest loss of $500,000.

As they have been all year, chemical companies were complaining about raw material costs in 1979's last three months. Du Pont attributes its 6% decline in earnings primarily to

Chemical industry leaders for fourth-quarter 1979 . . .

Rank	Sales	$ Millions	Earnings	$ Millions[a]	Profitability	Earnings as % of sales
1	Du Pont	$3176.5	Du Pont	$206.1	Freeport Minerals	20.0%
2	Dow Chemical	2447.3	Dow Chemical	143.6	Texasgulf	20.0
3	Union Carbide	2396.0	Union Carbide	131.9	International Flavors	13.5
4	Monsanto	1547.9	Allied Chemical	67.4	Big Three Industries	12.6
5	W. R. Grace	1471.9	W. R. Grace	63.9	Nalco Chemical	11.1
6	Allied Chemical	1298.3	Diamond Shamrock	58.5	Stauffer Chemical	9.7
7	American Cyanamid	857.0	American Cyanamid	45.5	First Mississippi	9.0
8	Celanese	814.0	Texasgulf	44.2	Petrolite	9.0
9	Diamond Shamrock	666.1	International Minerals	37.8	Diamond Shamrock	8.8
10	Hercules	596.0	Stauffer Chemical	35.9	Air Products	8.6

. . . and for full-year 1979

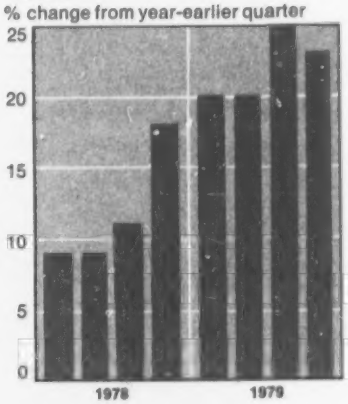
Rank	Sales	$ Millions	Earnings	$ Millions[a]	Profitability	Earnings as % of sales
1	Du Pont	$12,571.8	Du Pont	$938.9	Freeport Minerals	20.8%
2	Dow Chemical	9,255.4	Dow Chemical	733.2	Texasgulf	17.3
3	Union Carbide	9,176.2	Union Carbide	556.4	International Flavors	15.0
4	Monsanto	6,195.2	Monsanto	338.4	Big Three Industries	12.3
5	W. R. Grace	5,266.6	W. R. Grace	222.6	Nalco Chemical	11.1
6	Allied Chemical	4,332.4	Diamond Shamrock	178.1	Stauffer Chemical	8.9
7	American Cyanamid	3,187.0	Allied Chemical	175.6	International Minerals	8.5
8	Celanese	3,146.0	American Cyanamid	168.5	Petrolite	8.3
9	Diamond Shamrock	2,351.6	Hercules	144.5	Air Products	8.1
10	Hercules	2,350.0	Celanese	143.0	Dow Chemical	7.9

a After taxes. **Note:** For basic chemical companies with half or more of their sales in chemicals.

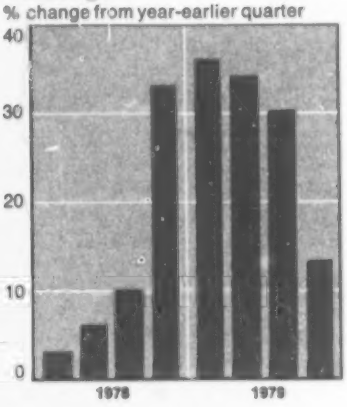
Chemical Industry 1979 Final Results

- Sales continued big gains
- Earnings increase slowed
- Profit margins fell again
- Production increased 4.1%
- Prices shot up 16.6%

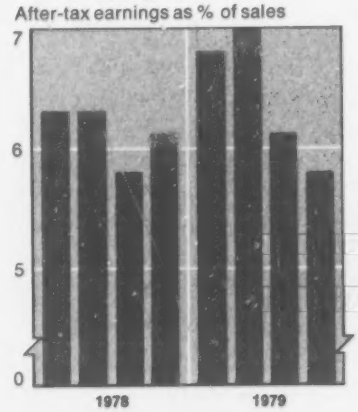
Sales
% change from year-earlier quarter



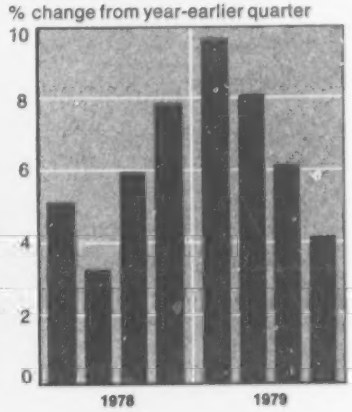
Earnings
% change from year-earlier quarter



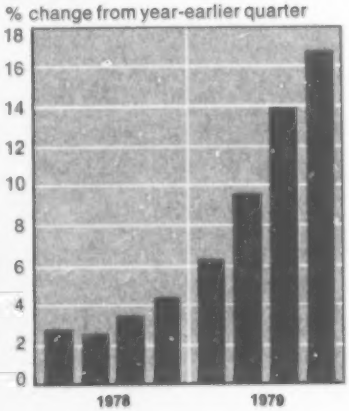
Profit margins
After-tax earnings as % of sales



Production
% change from year-earlier quarter

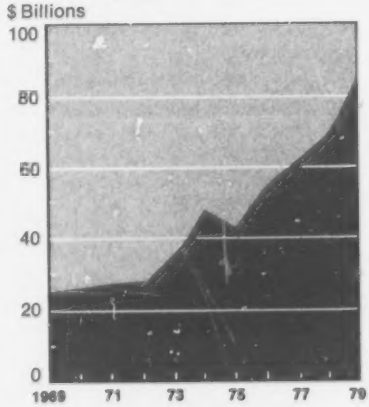


Prices
% change from year-earlier quarter

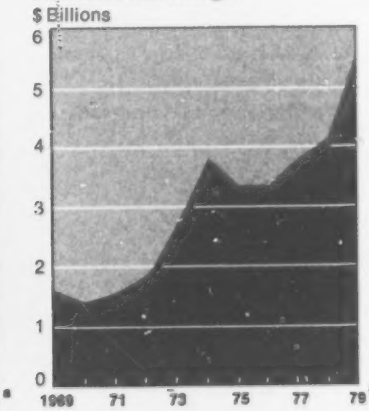


For the full year, sales increased 22% to top $83 billion, while earnings increased 28% to almost $5.3 billion; profit margins increased to 6.4%

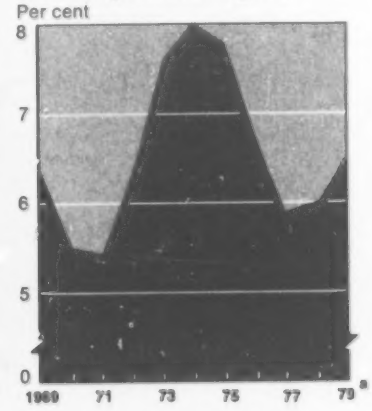
Annual sales
$ Billions



Annual earnings
$ Billions



Annual profit margins
Per cent



a C&EN estimates. Note: All sales, earnings, and profit margin data are based on the combined performance of the 40 largest basic chemical makers listed on page 10.

Fourth-quarter earnings increased 21% for chemical firms; profit margins off slightly

	FOURTH-QUARTER 1979						FULL-YEAR 1979			
	Sales	Earnings	Change from 1978		Profit margin[a]		Sales	Earnings	Change from 1978	
	($ millions)		Sales	Earnings	1979	1978	($ millions)		Sales	Earnings
Du Pont	$3,176.5	$206.1	11%	−6%	6.5%	8.2%	$12,571.8	$938.9	19%	19%
Dow Chemical	2,447.3	143.6	35	4	5.9	7.6	9,255.4	733.2	34	27
Union Carbide	2,396.0	131.9	15	22	5.5	4.9	9,176.2	556.4	17	51
Monsanto	1,547.9	18.2	19	−59	1.2	3.4	6,195.2	338.4	23	12
W. R. Grace	1,471.9	63.9	20	66	4.3	3.1	5,266.6	222.6	18	30
Allied Chemical	1,298.3	67.4	67	72	5.2	5.0	4,332.4	175.6	44	15
American Cyanamid[d]	857.0	45.5	16	4	5.3	5.9	3,187.0	168.5	15	8
Celanese	814.0	29.0	18	−17	3.6	5.1	3,146.0	143.0	21	28
Diamond Shamrock[d]	666.1	58.5	40	27	8.8	9.7	2,351.6	178.1	29	28
Hercules	596.0	26.8	18	8	4.5	4.9	2,350.0	144.5	21	40
National Distillers	558.7	32.6	6	6	5.8	5.8	2,114.9	117.3	14	20
Williams Cos.	460.1	23.4	35	e	5.1	e	1,850.0	69.5	24	151
International Minerals	443.5	37.8	28	35	8.5	8.0	1,642.5	140.0	17	24
Olin	441.0	15.5	8	5	3.5	3.6	1,800.0	71.1	13	13
Ethyl	431.1	22.0	14	8	5.1	5.4	1,657.0	97.5	16	13
Rohm & Haas	387.8	18.2	26	39	4.7	4.2	1,590.5	95.5	27	65
Stauffer Chemical	369.7	35.9	14	6	9.7	10.4	1,526.2	136.0	15	8
Cabot[f]	354.2	27.5	50	71	7.8	6.8	1,241.0	81.9	54	53
Air Products	317.4	27.3	15	12	8.6	8.9	1,271.7	102.9	18	24
Pennwalt	283.3	11.9	22	13	4.2	4.5	1,079.3	48.0	17	7
Akzona	275.6	6.9	23	25	2.5	2.4	1,012.4	25.6	17	23
Witco Chemical	261.1	9.5	24	−1	3.6	4.6	966.8	42.8	29	28
Reichhold Chemicals	222.4	2.5	18	−11	1.1	1.5	874.9	13.4	16	−8
Texasgulf	220.3	44.2	29	195	20.0	8.8	789.3	136.9	31	173
Lubrizol[g]	—	—	—	—	—	11.7	—	—	—	—
Thiokol[g]	—	—	—	—	—	4.2	—	—	—	—
Nalco Chemical	158.5	17.7	20	17	11.1	11.4	578.9	64.5	22	20
Ferro	157.1	8.7	18	—	5.5	6.6	592.9	30 9	20	12
Big Three Industries	136.0	17.1	16	10	12.6	13.2	509.6	62.8	19	11
Freeport Minerals	130.3	26.0	59	177	20.0	11 5	487.7	101.4	60	224
Liquid Air	98.7	6.3	32	117	6.4	3.9	369.1	24.7	21	35
International Flavors	92.1	12.4	7	2	13.5	14.1	409.3	61.5	12	9
Mallinckrodt[g]	—	—	—	—	—	8.8	—	—	—	—
First Mississippi	61.4	5.5	44	e	9.0	e	237.4	14.8	51	2,860
Crompton & Knowles	60.8	2.5	5	14	4.1	3.8	239.6	7.1	10	16
Baker Industries[g]	—	—	—	—	—	e	—	—	—	—
Petrolite	51.1	4.6	15	5	9.0	9.9	186.9	15.6	12	2
Royster	48.0	2.2	56	e	4.6	e	268.4	7.6	43	347
Stepan Chemical[g]	—	—	—	—	—	3.4	—	—	—	—
Virginia Chemicals	32.5	−0.1	19	e	e	3.1	131.3	4.2	19	6
Total 20 largest companies[h]	$19,317.0	$1073.0	23.0%	16.1%	5.6%	5.9%	$73,605.3	$4558.9	22.4%	25.7%
Total 15 other companies[h]	$2,005.9	$166.0	23.6%	61.0%	8.3%	6.4%	$7,648.5	$613.8	21.6%	58.9%
GRAND TOTAL[h]	$21,322.9	$1239.0	23.2%	20.6%	5.8%	5.9%	$81,253.8	$5172.7	22.3%	28.9%

a After-tax income as percentage of net sales. b Fully diluted before nonrecurring items and extraordinary charges for continuing operations. c As of Jan. 31. d Includes nonrecurring items. e Deficit. f 1979 results include acquisitions not included in 1978. g Not all data available at press time. h Averages except for sales and earnings.

what it calls sharp increases in prices of raw materials and energy. Du Pont says that prices paid for hydrocarbons, which include petrochemical feedstocks, increased 63% in the fourth quarter over the same period of 1978. And silver prices doubled, which had a great impact on the company's photographic products, which use large amounts of silver for x-ray, graphic arts, and industrial films. In all, Du Pont's index for all of its purchased materials increased 38% from the fourth quarter of 1978. At the same time its selling price index for the total company rose only 11%.

At Hercules, Alexander F. Giacco, president and chief executive officer, says that for the year as a whole, raw material costs were up 15.7% and energy costs were up 20.9%. He adds, "Should this trend continue into 1980, our success will depend on our ability to increase our prices to recover the higher costs, and our plans have been made accordingly."

At Rohm & Haas, feedstock costs in the fourth quarter increased 27% over the year before, but selling prices were up only 12%. And at Reichhold Chemical, president Peter J. Fass says that "operating margins were narrowed, primarily from continued rapid escalation in petrochemically derived raw materials, which increased in price more rapidly than product sales prices. Operating costs with high energy content continued their sharp increases, reflecting international crude oil and hydrocarbon price escalations."

FULL-YEAR 1979		Earnings per share[b]		STOCK MARKET DATA					
Profit margin[a]				Stock price[c]					
			Recent		Recent 12 months		Price-earnings ratio	Annual indicated	Dividend yield, %
1979	1978	4th qtr	12 months	Jan. 31	High	Low	Jan. 31	dividend	of price
7.5%	7.4%	$1.41	$6.42	$40 3/4	$45 7/8	$ 7	6.3%	$2.75	6.7%
7.9	8.4	0.80	4.05	34 1/8	35 5/8	24 3/8	8.4	1.60	4.7
6.1	4.7	1.99	8.47	43 3/4	47 7/8	35	5.2	3.00	6.9
5.5	6.0	0.50	9.23	56 1/4	62 3/4	45	6.1	3.40	6.0
4.2	3.8	1.37	4.79	41 3/4	43 1/8	25 5/8	8.7	2.05	4.9
4.1	5.1	2.20	5.95	56 1/2	57 3/4	28 1/2	9.5	2.00	3.5
5.3	5.6	0.95	3.52	32	36 1/8	24 3/8	9.1	1.60	5.0
4.5	4.3	1.94	9.46	48 1/2	50	39 3/4	5.1	3.20	6.6
7.6	7.7	1.10	3.37	33 3/8	35 1/2	19 1/8	9.9	1.60	4.8
6.1	5.3	0.60	3.27	22 1/2	24 5/8	16 7/8	6.9	1.10	4.9
5.5	5.7	0.96	3.41	30 1/4	32 1/2	19 3/8	8.9	2.00	6.6
3.8	1.9	0.86	2.55	36 1/2	38 3/8	17	14.3	1.10	3.0
8.5	8.1	2.08	7.15	54	61 1/2	38 3/4	7.6	3.00	5.6
4.0	3.9	0.64	2.97	17 1/4	25	16 1/8	5.8	1.00	5.8
5.9	5.8	1.07	4.77	29 5/8	30 1/2	22 1/4	6.2	1.50	5.1
6.0	4.4	1.40	7.39	42 1/4	48 1/2	33	5.7	2.00	4.7
8.9	9.5	0.81	3.10	18 7/8	25	17 3/4	6.1	1.10	5.8
6.4	6.6	2.65	7.91	61 1/8	62	34	7.7	1.60	2.6
8.4	7.5	0.96	3.63	38 1/2	42 1/8	25	10.6	0.80	2.1
4.4	4.5	1.20	4.81	33 3/4	35 7/8	30 1/4	7.0	2.20	6.5
2.5	2.4	0.57	2.10	14 1/8	17 1/8	11 3/8	6.7	0.80	5.7
4.4	4.5	—	—	29 1/4	33	20 1/2	—	1.40	4.8
1.5	1.9	0.26	1.43	13 1/8	16 1/2	11 1/8	9.2	0.74	5.6
17.3	8.3	1.18	3.71	47 1/8	50 1/4	21 1/8	12.7	1.20	2.5
—	13.0	—	—	62 7/8	64 1/2	41	14.4	1.80	2.9
—	4.6	—	—	56	58	30 1/2	9.8	1.55	2.8
11.1	11.3	0.83	3.18	32 1/2	35 5/8	27 3/4	10.2	1.60	4.9
5.2	5.6	1.14	4.07	22 5/8	27 3/4	19	5.6	1.20	5.3
12.3	13.2	0.85	3.13	46 5/8	47 3/4	31 5/8	10.1	0.88	1.9
20.8	10.3	1.24	4.84	62 3/4	66 1/2	30	13.0	1.50	2.4
6.7	6.0	0.58	2.49	24 3/4	28 3/4	23 1/2	9.9	1.40	5.7
15.0	15.4	0.34	1.68	19 3/4	24 3/8	18 1/4	11.8	0.80	4.1
—	7.9	—	—	29 1/2	33 1/4	26 3/4	9.0	1.20	4.1
6.2	0.3	0.64	1.73	31 5/8	33	12	18.3	0.40	1.3
3.0	2.8	1.08	3.05	18 7/8	18 7/8	14	6.2	1.20	6.4
—	e	—	—	13 3/8	16	4 3/8	—	—	—
8.3	9.2	0.78	2.64	45 1/2	52 1/2	35 1/4	17.2	1.08	2.4
2.8	0.9	0.31	0.43	15 3/8	16 1/4	4 5/8	35.8	0.40	2.6
—	3.8	—	—	21 1/2	23 1/2	16 1/2	7.8	0.92	4.3
3.2	3.6	−0.2	1.62	14 1/2	12 3/4	15 1/2	9.0	0.70	4.8
6.2%	6.0%								
8.0%	6.1%								
6.4%	6.0%								

And Dow Chemical happily reflects that although increased sales were fueled largely by price increases made necessary by huge jumps in energy and hydrocarbon costs, gains were made in real terms. G. J. Williams, financial vice president at Dow, says that in terms of physical volume, sales rose 10%. This increased volume, he says, was reflected in Dow's operating rate, which rose from 79% of capacity in 1978 to 84% for full-year 1979.

A weakness in certain parts of the economy—notably housing, construction and automobiles—is having a negative effect on chemical earnings. H. Barclay Morley, chairman and president of Stauffer Chemical, says that fourth-quarter volume in those areas reflects general economic conditions such as the automotive and housing markets, but that many of Stauffer's specialized products are continuing to show strength into 1980. John W. Hanley, chairman and president of Monsanto, says, "During the fourth quarter, inventory corrections by customers resulted in a significant drop in shipments and a modest buildup in inventory in our own plants. Products for the automotive and residential construction industries in the U.S. were particularly hard hit." And American Cyanamid says that the downturn in construction adversely affected its earnings.

One of the bright spots for earnings in the fourth quarter remained agricultural chemicals. Cyanamid's chairman and chief executive officer James G. Affleck says that the com-

Profit margins still rise for oil firms but drop for other diversified companies

	% Chemical sales	4TH-QUARTER 1979 Sales ($ millions)	Earnings ($ millions)	Change from 1978 Sales	Change from 1978 Earnings	Profit margin[a] 1979	Profit margin[a] 1978	FULL-YEAR 1979 Sales ($ millions)	Earnings ($ millions)	Change from 1978 Sales
OIL AND GAS COMPANIES										
Exxon[b]	6%	$25,295.0	$1,365.0	39%	60%	5.4%	4.7%	$84,350.0	$4,295.0	30%
Mobil[b]	3	14,490.0	541.0	36	72	3.7	2.9	47,946.0	2,010.0	28
Texaco	2	12,013.0	533.9	45	63	4.4	4.0	39,096.0	1,759.1	34
Standard Oil of California	4	9,800.0	524.0	44	66	5.3	4.6	31,800.0	1,735.0	29
Gulf Oil	9	7,727.0	366.0	42	54	4.7	4.4	26,137.0	1,322.0	30
Standard Oil (Ind.)	12	6,069.9	368.7	41	70	6.1	5.0	20,215.3	1,506.6	24
Atlantic Richfield	9	5,049.6	383.0	54	72	7.6	6.8	16,676.7	1,205.9	31
Shell Oil	18	4,301.3	331.2	47	72	7.7	6.6	14,546.2	1,125.6	31
Conoco	6	3,800.0	190.7	34	23	5.0	5.5	13,100.0	815.4	33
Tenneco	9	3,269.0	164.0	33	25	5.0	5.3	11,209.0	571.0	28
Sun Co.	3	3,200.0	222.9	52	107	7.0	5.1	10,800.0	699.9	42
Phillips Petroleum	16	3,044.8	306.5	38	180	10.1	5.0	9,744.8	891.1	31
Standard Oil (Ohio)	6	2,349.7	451.0	53	174	19.2	10.7	7,916.0	1,186.1	52
Union Oil[c]	11	2,213.4	152.3	32	23	6.9	7.4	7,700.0	500.6	26
Ashland Oil[c]	15	1,928.3	59.4	36	15	3.1	3.6	7,155.8	195.1	29
Cities Service	9	1,804.2	106.2	47	96	5.9	4.4	6,276.7	347.5	35
El Paso	10	906.0	27.6	56	−25	3.0	6.3	3,088.6	138.1	52
Northern Natural Gas	13	775.7	62.1	44	44	8.0	8.0	2,499.2	191.8	30
Kerr-McGee	18	755.5	40.4	39	1	5.3	7.4	2,683.5	160.0	29
American Petrofina	14	492.9	17.7	50	−13	3.6	6.2	1,622.6	83.2	38
DIVERSIFIED MANUFACTURERS										
General Electric	2	6,130.0	382.0	14	5	6.2	6.7	22,460.0	1,410.0	14
U.S. Steel[b]	7	3,000.0	−561.7	0	d	d	3.2	12,900.0	−293.0	17
Procter & Gamble	3	2,622.3	146.7	17	15	5.6	5.7	10,080.6	615.7	15
Eastman Kodak	20	2,587.1	294.7	12	−11	11.4	14.3	8,028.2	1,000.8	14
Esmark[b]	8	1,827.6	26.1	11	12	1.4	1.4	6,771.9	92.4	15
Firestone Tire & Rubber	9	1,419.0	25.1	4	24	1.8	1.5	5,284.4	102.9	8
Georgia-Pacific	8	1,371.0	70.0	16	−7	5.1	6.4	5,207.0	327.0	18
3M	15	1,367.0	167.2	15	14	12.2	12.4	5,440.0	655.2	17
Aluminum Co. of America	5	1,240.0	124.4	9	24	10.0	8.8	4,800.0	493.9	17
Borden	33	1,146.1	29.3	15	−11	2.6	3.3	4,312.5	134.0	13
FMC	35	884.6	40.0	7	7	4.5	4.5	3,307.5	151.6	8
PPG Industries	32	800.7	45.1	9	−9	5.6	6.7	3,100.0	208.9	11
B. F. Goodrich	36	775.3	14.8	14	−27	1.9	3.0	2,988.2	82.6	15
Pfizer	15	743.8	58.6	14	4	7.9	8.6	2,746.0	237.9	14
Borg-Warner	20	716.1	42.0	16	10	5.9	6.2	2,717.4	155.6	17
Kaiser Aluminum	14	713.7	63.8	12	87	8.9	5.4	2,926.5	232.2	20
Northwest Industries	11	691.4	48.5	16	18	7.0	6.9	2,579.9	172.2	9
Merck	16	629.6	81.7	19	14	13.0	13.6	2,384.6	381.8	20
General Tire & Rubber	10	619.2	15.6	−2	−48	2.5	4.8	2,294.9	81.7	4
Martin Marietta	12	569.4	37.3	12	2	5.6	7.2	2,060.8	178.0	17
Eli Lilly	21	541.4	70.5	14	9	13.0	13.6	2,205.8	329.5	19
Koppers	31	508.9	22.0	14	22	4.7	4.3	1,828.3	86.5	16
NL Industries	30	476.4	36.5	16	37	7.7	6.5	1,810.2	114.6	18
SCM	13	472.6	11.8	10	30	2.5	2.1	1,903.8	50.3	17
GAF	23	324.9	7.6	18	−14	2.3	3.2	1,213.2	28.2	14

a After-tax income as percentage of sales. b Earnings include nonrecurring items. c Sales exclude excise taxes. d Deficit. **Note:** Earnings are given before major nonrecurring and extraordinary items. Earnings at companies with major operational reshuffles are given for continuing operations. Earnings per share are fully diluted.

FULL-YEAR 1979			STOCK MARKET DATA							
Change from 1978 Earnings	Profit margin[a] 1979	Profit margin[a] 1978	Earnings per share 4th qtr	Earnings per share Recent 12 months	Stock price Jan. 31	Stock price Recent 12 Months High	Stock price Recent 12 Months Low	Price-earnings ratio Jan. 31	Annual indicated dividend	Dividend yield, % of price
55%	5.1%	4.3%	$3.10	$ 9.74	$ 60 7/8	$ 61 1/4	$48 7/8	6	$4.40	7.2%
78	4.2	3.0	2.55	9.48	58 3/8	60 3/8	36 1/4	6	3.00	5.1
106	4.5	2.9	1.97	6.48	34 7/8	37 1/8	23 5/8	5	2.40	6.9
64	5.6	4.4	3.06	10.44	62 1/2	62 5/8	44 3/8	6	3.20	5.1
68	5.1	3.9	1.88	6.78	39 1/4	40 1/4	23	6	2.25	5.7
40	7.5	6.6	2.45	10.23	87 5/8	89 3/4	53 1/2	9	3.60	4.1
50	7.2	6.3	3.11	9.81	95	97 1/4	57 3/8	10	3.40	3.6
40	7.7	7.3	2.15	7.32	64 1/2	69 1/4	30 1/4	9	2.40	3.7
61	6.2	4.6	1.77	7.58	53 1/8	55 7/8	28 3/4	7	1.90	3.6
26	5.1	5.2	1.49	5.16	42 3/4	43 3/4	29 1/4	8	2.40	5.6
69	6.5	5.5	3.55	11.15	81	81	42	7	3.00	3.7
63	9.1	7.4	1.98	5.77	54 1/4	55 7/8	30 1/2	9	1.80	3.3
163	15.0	8.7	3.71	9.83	100	102 3/4	44 1/2	10	2.00	2.0
31	6.5	6.3	1.76	5.76	53 3/4	54 3/4	33	9	1.30	2.4
13	2.7	3.1	1.89	5.69	41 5/8	45 1/2	32 3/4	7	2.20	5.3
72	5.5	4.3	3.83	12.54	99	99	53 1/8	8	3.60	3.6
27	4.5	5.3	0.59	2.99	27 3/8	28 5/8	16 1/8	9	1.48	5.4
35	7.7	7.4	2.75	8.45	55 1/4	58 5/8	35 1/2	7	3.00	5.4
35	6.0	5.7	1.56	6.18	74 7/8	76 7/8	46	12	1.55	2.1
157	5.1	2.8	1.65	7.77	40 3/4	44 3/4	24 1/2	5	2.50	6.1
15	6.3	6.3	1.69	6.20	55	56 1/4	45	9	2.80	5.1
d	d	2.2	−6.50	−3.41	19 3/4	26 1/8	16 3/4	d	1.60	8.1
13	6.1	6.2	1.77	7.45	72 1/8	86 7/8	70 1/4	10	3.40	4.7
11	12.5	12.9	1.82	6.20	48 1/4	66 7/8	44	8	2.40	5.0
15	1.4	1.4	1.24	4.40	28 3/8	32	23 3/4	6	1.84	6.5
43	2.0	1.5	0.43	1.78	8 5/8	13 7/8	8 1/8	5	0.60	7.0
8	6.3	6.9	0.65	3.03	28 3/4	31 3/8	23 1/2	9	1.20	4.2
16	12.0	12.1	1.43	5.59	49 1/2	64	46 5/8	9	2.40	4.8
58	10.3	7.6	3.51	13.99	63 1/2	64 1/2	48 3/8	5	3.20	5.0
−1	3.1	3.6	0.91	4.12	23 3/8	27 7/8	23 1/4	6	1.82	7.8
14	4.6	4.8	1.11	4.18	29 1/2	31 1/8	22 3/4	7	1.40	4.7
15	6.7	6.5	1.38	6.47	33 1/4	34 1/4	25 7/8	5	2.00	6.0
18	2.8	2.7	0.87	4.89	20 1/4	24	17 3/8	4	1.44	7.1
13	8.7	8.7	0.80	3.26	37 1/2	41 3/4	29	12	1.32	3.5
16	5.7	5.8	1.95	7.25	35 5/8	37 7/8	26 3/4	5	2.30	6.5
60	7.9	5.9	1.45	5.28	23	23 7/8	17 1/2	4	1.20	5.2
14	6.7	6.4	1.58	5.60	35 1/2	37 7/8	25 1/8	6	2.05	5.8
24	16.0	15.5	1.08	5.06	68 1/2	75 5/8	62 1/2	14	2.30	3.4
−29	3.6	5.3	0.66	3.44	17 3/8	26 7/8	18	5	1.50	8.6
31	8.6	7.7	1.50	7.10	54	56 3/8	30 1/8	8	2.12	3.9
19	14.9	15.0	0.97	4.52	57	63 7/8	47 1/8	13	2.10	3.7
28	4.3	4.0	0.83	3.27	27 3/8	28 3/4	17 3/8	8	1.40	5.1
31	6.3	5.7	1.08	3.36	38 5/8	39 3/8	20 1/4	11	1.20	3.1
26	2.6	2.4	1.15	4.80	22 3/4	32	16 5/8	5	1.30	5.7
−7	2.3	2.9	0.44	1.62	10 5/8	13	9 1/4	7	0.68	6.4

Oil companies' chemical earnings generally improved in 1979

Outside the basic U.S. chemical industry, the industry with the biggest stake in chemicals is petroleum. Centered in building-block petrochemicals, the chemical operations of oil and natural gas companies tend to be more cyclical than operations in the basic chemical industry. Over the past decade, petrochemicals were slow to feel the financial benefits of a business expansion, jumped suddenly in the last year or two of the expansion, and sank sharply at the beginning of the next expansion. Profits have tended to be a little or a lot.

In 1979, chemical profits were a lot for many oil and natural gas companies, especially the ones most dependent on petrochemicals. With high use of plant capacity, petrochemical producers were able both to pass along sharply increased raw materials and energy costs and to strengthen previously slim profit margins. As with basic chemical companies, U.S. exports and non-U.S. operations gave a major profits boost.

For example, Exxon, by far the biggest chemical power among oil companies, reports that its chemical earnings climbed 68% in 1979 from 1978 to reach $450 million. U.S. chemical earnings increased 30%, and non-U.S. chemical earnings more than doubled.

Exxon chairman C. C. Garvin Jr. comments on the foreign earnings: "Feedstock shortage and strong demand caused a recovery of depressed industry (profit) margins, particularly in Europe. Worldwide return on capital employed was 17.8% in 1979, slightly higher than for the corporation as a whole."

Chemical earnings for another major petrochemical producer, Gulf Oil, more than tripled in 1979 to $275 million. The leading influences behind the jump were increased demand for aromatics such as styrene and cumene as gasoline octane improvers and increased prices for plastics such as low-density polyethylene and polystyrene.

Amid the petrochemical prosperity, however, some oil companies received bad blows in chemicals last year. For example, Atlantic Richfield, which otherwise would have increased chemical earnings, went into the red in the fourth quarter as the company set up a $40 million reserve to cover the loss on its joint-venture ethylene glycol plant outside Houston. And Cities Service's chemical earnings slid into a loss for the whole year, in part because of a battered carbon black market.

$ Millions, operational earnings	Fourth quarter			Full year		
	1979	1978	% Change	1979	1978	% Change
Atlantic Richfield	$−29[a]	$29	b	$117[a]	$91	29%
Cities Service	−3	1	b	−1	16	b
Exxon	130	79	65	450	268	68
Gulf Oil	79	29	172	275	81	240
Mobil	18	31	−41	113[a]	86	31
Standard Oil (Ind.)	55	−4	b	202	46	344
Texaco	30	17	72	97	55	77

a Earnings lowered significantly by nonrecurring item. b Deficit in either 1979 or 1978.

pany's "agricultural segment performed exceptionally well" with animal feed and health products and fertilizers leading the way.

At Freeport Minerals, earnings from agricultural minerals in the fourth quarter increased 155% over fourth-quarter 1978 and more than 145% for the year.

And it seems that the fertilizer producers see the good times continuing despite uncertainty caused by the question of trade with the Soviet Union (C&EN, Feb. 11, page 6). At Royster, which manufactures phosphate fertilizers, J. W. Parnell Jr., president and chief executive officer, says of the U.S. embargo of grain shipments that speculation about further measures and possible changes in Department of Agriculture programs has created some uncertainty regarding farmers' planting intentions and government set-aside programs. "Thus far, however, we do not see an impact materially affecting Royster," Parnell says. And he expects strong domestic demand for fertilizers to last into spring.

And at International Minerals, chairman R. A. Lenon says that the U.S. embargo on shipments of grain to the Soviets will have no short-term impact on the company's fertilizer business, and, as seen now, very little impact longer term. "The outlook for fertilizers has been progressively improving," Lenon says.

Fertilizer also was a good investment in 1979 for the many diversified producers outside the basic chemical industry with a stake in this market. The same optimism carries into 1980, unlike prospects for a number of other chemical businesses.

For example, Borden's chairman, Eugene J. Sullivan, says that the company's fertilizer operation had an excellent year in 1979. This performance and an outstanding year for the company's petrochemical-based products, notably polyvinyl chloride, more than offset lower profits from construction-oriented thermoset resins.

The Estech unit of Esmark also notes strength in 1979 in fertilizer and says that the outlook for world fertilizer prices continues to be optimistic. Estech's overall chemical results in 1979 also showed higher operational profits before nonrecurring items.

Some agricultural specialties turned in large gains in 1979. At Eli Lilly, the hugely successful herbicide, Treflan, powered agricultural chemical sales to a 40% gain to $470.8 million in 1979. Lilly doesn't disclose profits for this product line.

In nonagricultural chemical markets, a number of diversified companies report improved results in 1979 although other of their major product lines deteriorated financially. For example, while construction-related lines such as wood and glass began to feel weakness in 1979, chemicals were strong for Georgia-Pacific and PPG Industries.

In the photographic industry, both Eastman Kodak and GAF report strong chemical operations in 1979 while soaring silver costs hurt photographic profits.

Possibly the company with the most to thank chemicals for is U.S. Steel. The company's restructuring in its core operations cost it an $808.6 million pretax write-off in the fourth quarter, producing an earnings deficit for both the quarter and the year. However, chairman David M. Roderick says, "Operating income for the nonsteel business segments improved significantly, with chemicals showing the most improvement." For 1980, U.S. Steel expects seven major chemical projects, started up in late 1979, to reach full production capability early in the year.

With such results, essentially nonchemical companies cashed in on chemicals' unexpectedly good year in 1979. The fourth quarter kept up the financial steam with some exceptions in auto- and housing-related products.

For 1980, there are few signs yet that chemical producers are being dragged into a spreading recession. However, the year's uncertainty is high, and no one expects a repeat of 1979's gain soon. □

R&D gets heavy emphasis in West Germany

In addition to generous funding by chemical firms, there is unique and constant interaction among industry, its leaders, and universities

Dermot A. O'Sullivan
C&EN, London

Geist, geld, geduld, und glück! Brains, money, patience, and luck! This is how Paul Ehrlich, considered the "father" of chemotherapy, summed up the four essential elements needed for success in research.

The sentiment holds as true now as it did at the turn of the century when the late German Nobelist said it. The result today is a chemical R&D establishment in West Germany unique among the world's chemical industries.

Heavily funded—more so than in the U.S. by relative measures, highly stable, and strongly growth oriented, R&D at West German chemical firms has an added distinction of close ties to universities. The latter characteristic contrasts with weakening academic-industrial ties in chemical research in the U S.

One comes away from discussions with West German chemical industry leaders with the distinct impression that the future of the industry is bright. Despite the much-emphasized concern over such problems as rising raw material costs and the growing threat of bulk commodity organic chemicals becoming available from so-called developing countries, established producers promise to override these issues through technical ingenuity and creative skills.

Measured by any parameter, global R&D spending patterns of the three largest West German ("Big Three") chemical companies—BASF, Bayer, and Hoechst—are impressive. Between 1969 and 1978, the latest year for which data are available, Bayer doubled its R&D spending worldwide to more than a billion deutsche marks (about $564 million at the 1978 conversion rate). For both BASF and Hoechst, 1978 R&D spending was more than two and a half times what it was in 1969—$459 million for BASF, $593 million for Hoechst.

Too, over the past 10 years, the degree of spending every year outpaced that of each preceding one. The rise was unswerving, regardless of whether sales, or, more significant, net profits rose or fell. Again from 1969 to 1978, the average annual rate of increase was 11.5% for BASF, 8.1% for Bayer, 11.3% for Hoechst.

Last year was no exception and outlays went up a further notch. Estimated R&D investment by BASF in 1979 was $523 million, on the basis of last year's conversion rate. Bayer's was $654 million, and Hoechst's was $656 million.

As a percentage of world sales, total R&D spending has remained remarkably constant. For BASF, it averaged about 3.5% of annual sales each year during the past 10 years. For Bayer and Hoechst, the average was closer to 4.5%.

When gauged against global net profits, however, the R&D spending pattern was quite different. BASF averaged 131% of net profits annually over the past 10 years, Bayer 167%, and Hoechst 188%. But these averages mask the percentage swings. For example, for Hoechst, the variation moved from a low of just under 100% of the 1969 worldwide net profit figure to a remarkable 343% in 1977. The reason for the variation, of course, is that whereas net profits rose and fell from year to year, the R&D spending increase was maintained.

Karl Heinz Büchel, director of research at Bayer in Leverkusen, observes: "In absolute figures, when one extrapolates against the inflation rate, other international chemical concerns show a leveling of their R&D effort. We don't have this up to now."

It's obvious, too, that members of the corporate management boards of BASF, Bayer, and Hoechst maintain a long-range view when assigning money to R&D each year. Annual funding has remained immune to annual variations in net profits.

"R&D spending is not cyclical here," says Horst Pommer, research director of BASF in Ludwigshafen.

Adds Klaus Weissermel, his counterpart at Hoechst in Frankfurt: "Our general strategy is to continue our research effort and to have independence whether business is excellent or not. Research efforts are more and more important for the future. And to achieve success, research needs time. So it should not be interrupted."

C&EN staff photo

Buchel: no leveling in R&D effort

Büchel, Pommer, and Weissermel are full members of the executive boards of their respective companies. When the annual budgets come up for discussion and debate, they have understanding listeners, since a preponderance of their fellow board members are chemists too. For that matter, the boards' chairmen—Herbert Grunewald at Bayer, Rolf Sammet at Hoechst, and Matthias Seefelder at BASF—themselves are chemists of international repute and with long company experience behind them.

BASF's approach to drawing up its R&D budget is somewhat similar to the approach that Bayer and Hoechst take. "We have a central planning department here in Ludwigshafen," Pommer explains. "This ties together all the company's operational activities and plans.

"In the course of the planning procedure, there are three planning periods. One is a strategic plan covering a period of roughly 10 years or more. The second is a five-year plan. The third is the first year of the five-year plan, the budget year. R&D, of course, plays its role in this whole planning procedure.

"We review the five-year plan each year and make adjustments if necessary. This plan is drawn up by the heads of each of the company's 20 divisions together with the people from R&D. Within each field of company activity, the corresponding divisional heads and the research people with something to say meet to discuss single or group projects.

"One member from central research sits in on these divisional meetings. This results in a very close contact between the divisions and the work at central research."

Peter Haug, who is responsible for planning, coordination, and control of research for BASF, adds: "Each division within BASF is responsible for production, marketing, and product development of its range of products. The division head covers that spectrum. The R&D people bring in the research side."

Day-to-day management of R&D has become increasingly complex as the companies have expanded. BASF, Bayer, and Hoechst now are truly international chemical companies with wholly owned affiliates in most of the major West European countries and as far afield as Japan and the U.S. The larger of these affiliates have their own research staffs and R&D projects. But the reins of control remain firmly in the hands of the managers at corporate headquarters in West Germany.

"There are two situations here, the easy ones, and those that are less easy," Büchel points out. "The easy area is where the activities of a foreign affiliate match those of one of our domestic divisions. Chemagro, the agrochemicals arm of Mobay Chemical in the U.S., is a good example. Work there is very closely coordinated with our agrochemicals division here in West Germany. You find this, too, between Miles Laboratories [in the U.S.] and our pharmaceutical division.

"Another example is Cutter Laboratories in Berkeley, Calif., acquired in 1974. That was a real diversification for Bayer. Cutter is doing research in serum fractions, blood plasma infusions, and other health care products for human and veterinary use. It now is fully integrated into the strategy of our pharmaceuticals division.

"The less easy situation is when the affiliate is in a completely different line of business. Agfa-Gevaert is one example. We don't have any direct research activity in photography here in the main Bayer company."

Büchel chairs a commission that seeks to harmonize the R&D activities of the nine company divisions, the affiliates, and those of the central corporate research facilities. The commission meets every three months to evaluate the aims and progress of what is being done.

About 44% of Bayer's annual R&D budget is spent by affiliates, 41% by the divisions, and the 15% balance by the corporate research facilities. These include a central R&D labo-

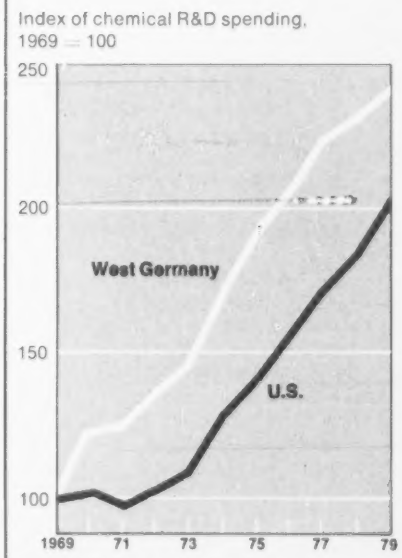
West German chemical R&D support relatively greater than in U.S.

Support for research and development by the West German chemical industry greatly outstrips R&D funding by U.S. chemical companies as a percentage of sales or profits. In addition, over the past decade, relative West German R&D support has held up much better than in the U.S. Even absolute R&D spending figures have grown faster in West Germany than in the U.S. This has occurred despite the considerably higher U.S. inflation rate.

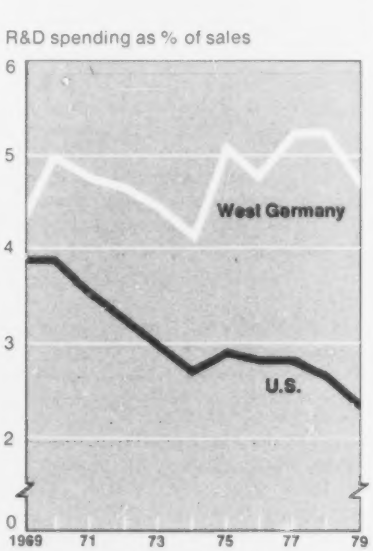
Specifically, R&D spending by the West German chemical industry was about 4.9% of sales in 1979, about double the 2.4% rate of the U.S. basic chemical industry. One factor in the high West German percentage may be relatively more drug research than in the U.S. However, a more important factor may simply be the consistency in the West German percentage over a decade when the figure fell sharply in the U.S.

U.S. R&D managers point out that U.S. inflation tends naturally to pull down U.S. R&D spending as a percentage of sales, since inflation in front of cost has outrun inflation in R&D. However, the same reasoning could apply to some extent to R&D spending in West Germany.

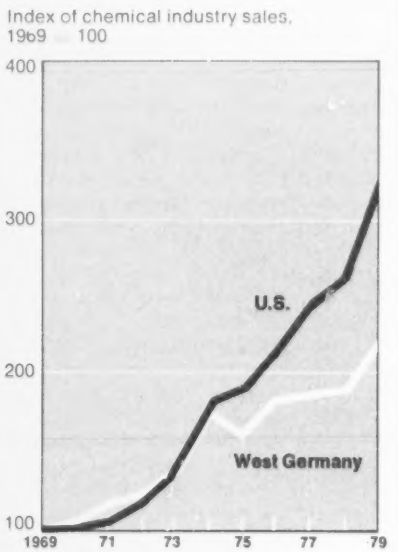
The higher U.S. inflation rate, reflected in a higher growth rate for chemical sales in the U.S., might actually push up U.S. R&D spending faster than in West Germany. But it hasn't. While basic chemical companies' R&D support in the U.S. has about doubled in the past decade, R&D support in West Germany's chemical industry has gone up nearly two and a half times over this period.



Sources: Verband der Chemischen Industrie, C&EN calculations



Sources: Verband der Chemischen Industrie, C&EN surveys



Sources: C&EN survey of 17 major U.S. basic chemical companies, Verband der Chemischen Industrie

ratory and an applied physics department.

Corporate research entails long-term, fundamental studies that aren't division-oriented. At the same time, more than half the work at the central research facilities is undertaken for the divisions. "This prevents corporate research from becoming an ivory tower," Büchel remarks. "People are kept practically oriented and maintain their expertise in applied chemistry."

The viable and dynamic nature of the chemical industry entails the need for continually evaluating the direction that R&D efforts should take. "It is important that we achieve a good mixture of 'young' and 'old' products," Hoechst's Weissermel points out. "One goal of each of our 15 divisions is to maintain a product mix. This is part of our daily work."

Pommer at BASF offers much the same line of thinking. "We are going more into fine chemicals and specialty products. On the other hand, it would be very dangerous for BASF to neglect the base chemicals and concentrate only on the sophisticated chemicals."

Apart from the changing pattern of product research, studies on new or improved processes are taking a larger slice of the R&D pie than in the past. Weissermel observes: "There is continuing need for processes that work as effectively as possible with respect to energy use, raw materials, and ecological considerations. In general, process-oriented work dominates in those areas involving bulk products."

Biotechnology is a relatively new area of research on which BASF, Bayer, and Hoechst are putting increasing emphasis. "In the past, biotechnology studies at Hoechst centered on classical fermentation techniques to produce antibiotics," recalls Weissermel. "Now we have switched to new fermentation methods. We started with single-cell proteins. We will explore what can be done with naturally occurring resources, how they might be converted to chemicals in general."

Bayer's Büchel says, "We will definitely intensify our research efforts in this area. Bayer already does this through Miles Laboratories where we are one of the largest citric acid producers from starch. There is a link between biotechnology and the aim of the chemical industry to switch to renewable resources. It also holds the potential of saving energy because high temperatures and high pressures aren't required."

Interest is growing, too, in genetic engineering. "We are doing some work at Miles," Büchel says. "And we are setting up a unit in the biochemistry department of our pharmaceutical division."

Hoechst, however, is most enthusiastic about the future prospects of genetic engineering. It sees it as a natural outgrowth of the company's long involvement in the production of insulin from animal glands.

"Based on this experience, it was decided about 20 years ago to establish a synthetic peptides group," explains Günther Seidl, head of Hoechst's pharmaceutical research. "The main object was to do some insulin synthesis studies. We have since acquired important background knowledge on hormonal regulation by peptides, and a better understanding of endocrinology and peptide chemistry."

More recently Hoechst scientists have turned their attention to genetic engineering. "Our first objective was to produce insulin," Seidl says. "Using a strain of *Escherichia coli*, we have achieved gene expression and isolated a product that behaves immunologically like insulin. We are also studying interferon production. We have had some success already, but we still have a long way to go to achieve production in commercial quantities."

Hoechst's Weissermel admits, "It will take time, of course. But this is normal when you begin in any new field. Our hope is that some of our future synthetic workers will be bacteria."

E. coli aside, there is a changing pattern in the qualifications of scientists being hired by the R&D departments at BASF, Bayer, and Hoechst. Chemists still are in high demand. But a greater proportion of people are being sought with expertise in other disciplines such as microbiology, physics, electrical engineering, and computer science.

Close connections with university scientists is one of the distinguishing features of the West German chemical industry. It has a long tradition, going back to the early days of organic dyes development more than a century ago.

On an industrywide scale there is the Fonds der Chemischen Industrie. This is a fund that all the country's chemical companies pay into. The money is used mainly to aid the work of university professors and to further chemical education.

"The Fonds der Chemischen Industrie is a marvelous thing to have," says Hans Bock, chairman of the Institute of Inorganic Chemistry at Frankfurt University. "It is essentially nonbureaucratic and the funding is very straightforward."

But in addition to the fund, there

Pommer: ad hoc collaboration is best

are other ways whereby university people, especially those of professorial rank, get financial support from the chemical industry in West Germany. One is through a system of contracts. Each contract is arranged on an individual basis between the company and university professor, and may extend for a few months or for several years. The company pays a stipend that the professor can accept whether or not he or she gets a grant from the fund.

Bock, 1975 recipient of the Frederic Stanley Kipping Award in organosilicon chemistry administered by the American Chemical Society, and recent developer of a special technique for gas-phase analysis of heterogeneously catalyzed reactions, points out that there usually are no strings attached to the arrangement of direct company funding. The professors apply the money to further their research. It need not have any direct bearing on the commercial emphasis

Weissermel: goal is good product mix

of the company providing the money.

Those who get such research grants are free to publish their findings. There is a tacit understanding, on the other hand, that should a discovery emerge of direct interest to the sponsoring company, then that company is given first option to evaluate it. If it is patentable, the company pays the costs of drawing up the documents and filing them, but the professor is listed as the inventor. "This may lead to a delay in publication of six months or a year from the legal standpoint," Büchel says, "but it is in the professor's ultimate best interests."

In addition, there are, of course, consultancy contracts between chemical companies and university professors. Under the terms of such contracts, specific company research problems are discussed.

Pommer notes that BASF has no consultancy agreements as such. The approach Pommer favors is what amounts to "ad hoc" collaborations. These might last six months or a number of years, depending on the circumstances. He is highly selective of those he seeks to collaborate with. "We choose them on the basis of what they are working on, not the university they are associated with," he says. "We know personally some 50 or 70 professors who not only are good friends of ours but who do highly sophisticated work. We talk to them about our problems, and they talk to us about theirs. It's a case of give and take."

There are other ways in which West German academics may get material assistance from the large chemical companies. Frequently the companies supply chemicals that either are expensive or difficult to obtain. Occasionally, a company will undertake physical or chemical analyses, that call for highly specialized equipment, on compounds made in university labs.

The flow of this kind of cooperation is by no means unidirectional. There are times when a company may seek the help of someone at a university who is an authority in a particular area. "Chemical industry innovations increasingly are interdisciplinary events," Büchel points out. "It can happen that an industrial R&D department may not have the broad spectrum of expertise needed at a particular time in a research program."

He stresses, however, that "we are not trying to manipulate universities by bringing very highly specialized work to them. We don't believe it is good to burden universities with special problems of industry. This is a general philosophy [on which] we in industry speak with one voice."

For their part, research managers in the chemical companies realize the advantages to them of maintaining good relations and an open avenue of communication with the country's foremost professors of chemistry. They realize, of course, that these professors attract the keenest students. And it is no coincidence that many of these bright graduate students ultimately find a place in the R&D department of industry. "In return for our support of professors' research, we hope at least to get an early offer of their good students," Büchel admits.

Adds Pommer, "From our collaboration programs we get an idea of the potential of the people who might be good for us." He notes that practically all the young people who join BASF with a degree in the natural sciences come directly from universities. "Only about 1 or 2% of them come to us from other companies," he says. "We don't advertise openings in our R&D department except in the pharmaceutical field where we need specialists."

Lecture and teaching programs further strengthen the bond between the West German chemical concerns and the universities. All of the corporate directors of research, and most in the top echelons of R&D management, have professorships in leading universities, as, indeed, do the board chairmen of BASF, Bayer, and Hoechst. Such continuing involvement in academic life is something unique for West Germany.

"The natural sciences faculties of our universities like to have industry people on their teaching staffs," Büchel says. "It's not just for honorary reasons. They are aiming at an additional teaching contribution from the applied side. Particularly in chemistry, there are some areas where industry has more or less a monopoly position on knowledge."

These assignments aren't taken lightly. Büchel holds a professorship at Aachen University's chemistry department. He lectures there frequently on such diverse topics as agrochemicals, pharmaceuticals, and the place of heterocyclics in commercial products. He also deals with broader issues, such as the future of raw material and energy resources, biomass, and the like. As part of the course, the students are invited to visit Bayer's chemical complex at Leverkusen where they have the opportunity to view first hand practical aspects of the subjects dealt with in the lectures. "All this exposes students to the realities of industrial life," he remarks.

BASF's Pommer, who has an honorary professorship in organic and applied chemistry at Braunschweig University, has lectured on the synthesis of vitamins and fine chemicals, describing the role of research in a large chemical concern. "Many of my BASF colleagues do this," he says. "The aim is to bring to the attention of young students and professors some ideas about what industry is doing in chemical research."

Weissermel of Hoechst has an appointment at Braunschweig University, too. He gives about six double-hour lectures each year as part of the regular chemistry course there. "It takes a lot of time," he admits. "It's not just a case of giving a few lectures, but the many hours required for their preparation."

According to Weissermel, more than 25 of Hoechst's senior scientists are lecturing at universities. "We don't want to compete with the professional academics," he says. "What we teach is applied research so that people can come to a better understanding of what this entails. We also touch on some of our problems and methods we use to solve them in an industrial environment. We wish to open the eyes of students and professors to the solving of practical problems."

Weissermel's involvement in chemical education matters goes still deeper. For the past six years he has been president of the Fonds der Chemischen Industrie. One of its functions is to grant funding to high school and university chemistry students. And he chairs a commission of the Gesellschaft Deutscher Chemiker (West German Chemical Society) that plans the content of refresher courses for those who have graduated from university five or more years previously.

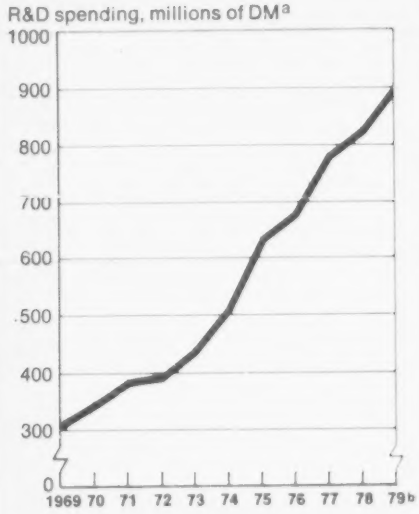
When the need arises, companies send some of their chemists back to universities for training in specialized techniques, particularly in the analytical field. "They stay for about six months," Pommer notes. "But BASF does not have sabbatical leaves as such."

Hoechst, on the other hand, does have a sabbatical leave policy. Right now several company scientists are spending some time in the U.S. Two are in Washington, D.C.—one at the National Institutes of Health's department of metabolic diseases and the other familiarizing himself with atmospheric chemistry research and analysis at the National Bureau of Standards. Two others are at the University of California Medical Center in San Francisco. There, one is acquiring fundamental techniques in genetic engineering; the other is

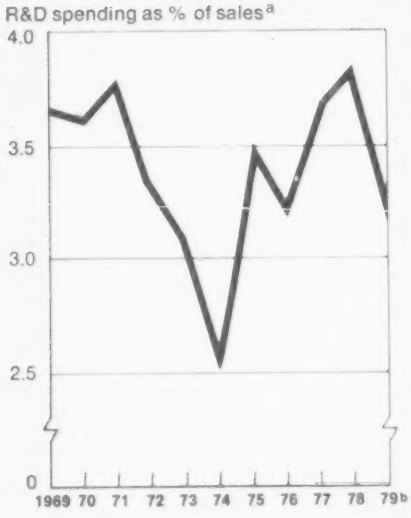
R&D spending is increasing for West Germany's three major chemical firms

BASF

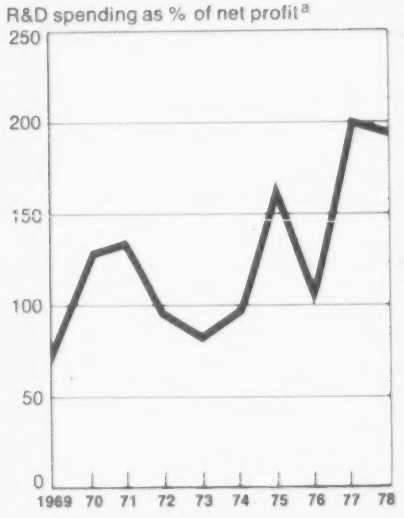
R&D spending, millions of DM[a]



R&D spending as % of sales[a]

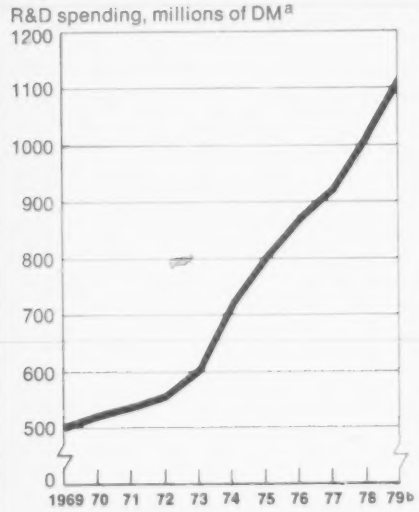


R&D spending as % of net profit[a]

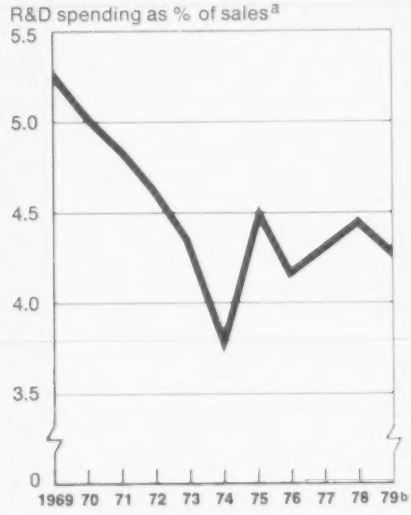


Bayer

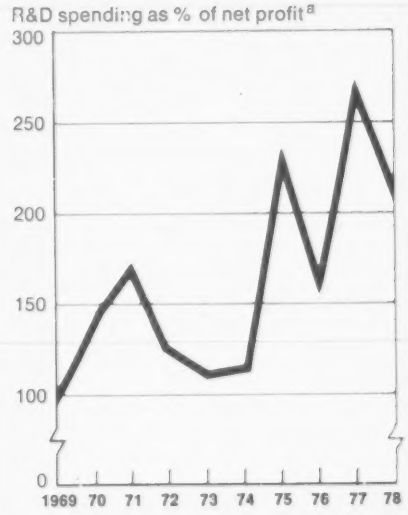
R&D spending, millions of DM[a]



R&D spending as % of sales[a]

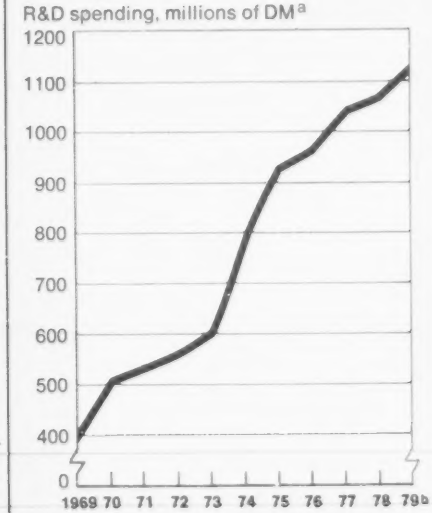


R&D spending as % of net profit[a]

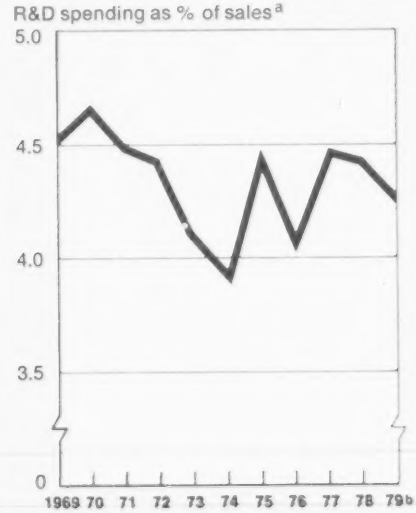


Hoechst

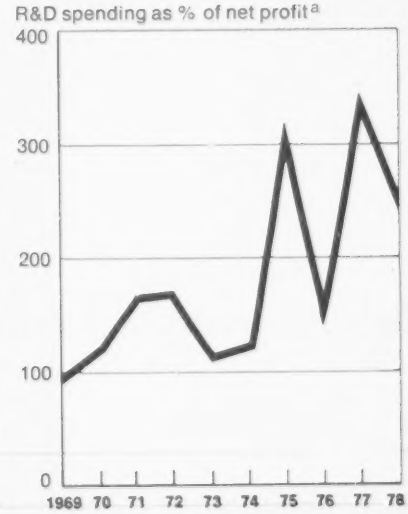
R&D spending, millions of DM[a]



R&D spending as % of sales[a]



R&D spending as % of net profit[a]



a Worldwide. b Estimate. **Note:** $1.00 = 1.72 DM, Dec. 31, 1979.

Group channels funds from chemical industry to education

"The Fonds der Chemischen Industrie [Chemical Industry Fund] is a unique organization," asserts Burchard Ording, executive director at its administrative headquarters in Frankfurt. "It is not only unique to this country, but no other industry branch here has a similar body."

The fund falls within the organizational structure of the Verband der Chemischen Industrie (Chemical Industry Association). It channels financial support from the West German chemical industry to students and chemistry teachers throughout the country's high schools, technical colleges, and universities. It awards annual cash prizes in certain fields of chemical excellence, compiles data, and publishes a variety of literature. And it continues to play a role in helping shape the country's science education policies.

The management board of the fund has 15 members. Ten are corporate directors of research in companies, five are university professors. Klaus Weissermel, head of chemical research at Hoechst, is the current chairman.

It was established in 1950 at a time when West Germany's postwar chemical industry and education system were in dire need of reconstruction. It set out with two primary objectives. One was to readapt the country's basic research to international standards. The other was to foster greater emphasis on the natural sciences in general and on chemistry in particular in the higher educational system.

Three men did much to shape the organization at the outset. One was W. Alexander Menne, board member for research at Hoechst and president of the verband at the time. Another was Theo Goldschmidt, a prominent West German chemical industrialist. The third was Otto Bayer, board member for research at Bayer and the fund's first chairman.

The first order of business of the early founders was to generate capital for the fund. They adopted a formula that imposed a monthly levy of 0.50 DM per employee for every chemical company in the country. This "fee" has risen to 1.85 DM (about $1.10 at the current exchange rate) per month for every worker. Last year, 7.7 million DM ($4.53 million) was obtained.

The funding formula is being revised. Future company contributions will be keyed to annual sales rather than to the number of employees. For every 10,000 DM ($5880) in sales, companies will pay 1.20 DM (71 cents) to the fund. The reason for the switch, Ording explains, is that the number of workers in West Germany's chemical industry has declined somewhat in the past few years and likely will remain static for the next several years. Meanwhile, inflation is putting a squeeze on the fund's financial resources.

C&EN staff photo

Ording: a unique organization

Some of the Chemical Industry Fund's money provides scholarships for students and teachers who want to take a higher degree in chemistry. The fund awarded some 4800 such scholarships between 1951 and 1979. Last year alone the number was 80.

Grants also are made to about 1200 professors doing chemical research at universities. The only criterion for awarding research grants is that the individuals be regarded by their peers as capable of making significant contributions to the science. The specific nature of the research isn't a factor in the decision. The work might be in a highly academic and specialized field of no apparent relevance to the practical world of the chemical industry. On the other hand, it also could center on a topic like polymerization or catalysis having a direct bearing on the industry.

Chemists who receive research grants from the fund may use the money as they see fit for their studies. They may even apply it against the cost of travel in connection with their work. Grants aren't intended to go toward purchase of equipment, however. Such purchases, Ording notes, should be made from their university budgets.

A research grant can vary from about 4000 DM ($2400) to 45,000 DM ($26,500). The amount given usually spreads across a two- to three-year period.

When the project for which the money is received is completed, the researcher usually provides the fund with an account of the work and the findings, together with any publications that might arise from it. But there is no obligation that this be done.

Grant applications aren't made directly to the fund. Instead, a grants committee appointed by the fund's management board decides who should get financial help. There are five such committees covering biochemistry, inorganic chemistry, organic chemistry, physical chemistry, and macromolecular and technical chemistry combined. Each committee comprises five experts in the particular field drawn from universities.

"The fund is very selective in making scholarship and research grants," Ording says. "There is a great deal of deliberation to ensure that the money goes to those most worthy of getting it. The object is to sponsor the very talented people, consequently, the number of awards made each year to highly qualified postgraduates is fairly small."

The fund also awards cash prizes annually. One, for 10,000 DM ($5900), goes to a person who has made an outstanding contribution to chemical literature. Five prizes go to university teachers under 40 years of age judged to have done some original chemical research.

The fund issues a variety of publications aimed at specific "target groups," as Ording puts it. The material is compiled by experts in industry and universities selected by the fund. Ording's staff coordinates its preparation.

One publication details chemical research in West German universities. It also lists professors and staff members there. It appears every five years or so.

The fund also prepares guides for high school chemistry teachers. These consist of slides and manuals giving technical information on latest developments in topics such as petrochemicals, polymers, corrosion research, and the like. "One of the aims is to provide chemistry teachers with concrete up-to-date examples of the chemical industry at work," Ording says.

A series of brochures is issued periodically, mainly for students considering studying in chemistry. These deal with such topics as the kind of work and job prospects in the industry, what managers look for when recruiting, and highlights of chemical research sponsored by the fund.

Besides promoting the advancement of West German chemistry, Ording says that the fund continues to have an increasing influence on the development of the country's university education policies. And indications are that it will continue in this role in the future. "We frequently are called on to give advice to various legislative bodies in the field of higher chemical education," he says.

Chemists chair boards at three largest West German chemical companies

Chemical companies in West Germany have a preponderance of scientists among their top executives. At the three largest companies—BASF, Bayer, and Hoechst—chemists rank prominently on their senior boards of management.

For instance, 10 of BASF's 11-man board of executive directors have doctorates—six of them in chemistry, one in chemical engineering, two in engineering, and one in economics. At Bayer, 11 of the 13-member board of management have doctorates—six in chemistry, one each in engineering, physics, and medicine, and two in law. At Hoechst, among the 14 members of the management board are nine with doctorates—five of them in chemistry.

Moreover, BASF, Bayer, and Hoechst are unusual among the major international chemical firms in that their chairmen rose from the ranks of the companies through chemical research and production. Somewhat unusual, too, is that they have spent their entire professional careers in the companies they joined some 30 years ago.

Matthias Seefelder, 60, chairman of BASF's executive board, is regarded by his colleagues and his peers as "a chemist's chemist." Like many West Germans his age, his studies were interrupted by the war. He entered the University of Munich in 1947 and emerged in 1951 with a doctorate in chemistry. His research there centered on diimide chemistry.

He moved to Leverkusen, where he went to work in BASF's central research laboratory. He undertook pioneering research on intermediates for the production of vitamins A and E, as well as in the field of dyes chemistry. Seefelder was appointed head of BASF's dyes laboratory in 1962 soon after it was created. Five years later, he moved out of the laboratory into management as head of the dyes division.

In 1973 Seefelder was elected a full member of BASF's executive board. His responsibilities centered mainly on expanding the company's production and business outside West Germany, including coordinating activities in Eastern Europe. He succeeded Bernhard Timm as chairman in 1974.

Herbert Grunewald, 59, chairman of the board of management at Bayer, began his chemical studies at Frankfurt University but later enrolled at the University of Heidelberg. He received a Ph.D. degree there in 1956. His research included studies on the synthesis of cane sugar and on valonea, an extract from acorns used in tanning.

Grunewald joined the chemical intermediates department of Bayer in Leverkusen the same year. Ten years later he became department manager with the added responsibility of running the company's organic chemicals analysis laboratory and its central organics pilot plant.

Grunewald was appointed to Bayer's board of management in 1968. Soon after, he became directly involved in coordinating the company's worldwide activities when Bayer underwent a major corporate restructuring. He became chairman in 1974.

Rolf Sammet, 60, chairman of Hoechst's board of management, became involved in chemistry as an outgrowth of his interest in photography. He studied at Stuttgart University and obtained a Ph.D. degree there in 1945 for research in inorganic chemistry.

In 1949 he joined Hoechst, then part of the I.G. Farbenindustrie combine in the solvents laboratory, several years later moving to the company's technical directorate. There he was in charge of organizing and restructuring the synthetic fibers division. When Hoechst expanded in polyester fibers, he was made head of the fibers operations at Bobingen, near Augsburg.

Following seven years as head of Hoechst's technical directorate in Frankfurt, Sammet was appointed to the board of management in 1964. He was responsible for plastics film activities and also was director of Hoechst's extensive manufacturing complex just outside Frankfurt. In 1969, he succeeded Karl Winnacker as chairman of the management board.

associated with the department of gastroenterology.

"Frankfurt is their base," comments research director Weissermel. "But don't forget, Hoechst is an international concern. We believe it is helpful for the future to establish good personal contacts in different places with people who are leaders in their fields and who are at the forefront of new disciplines."

There are instances, too, in which West German professors go to the chemical companies to learn. "This is particularly the case in the area of chemical engineering at universities," Pommer points out. "One needs firsthand knowledge of operating large equipment, high-pressure apparatus, and the like.

"Those who are invited to BASF for such training are highly selected. While with us, they work on special company projects. We promote this because the professors, through the knowledge they gain, are in a better position to give the right kind of lectures to their students. And the industry needs good chemical engineering graduates from the practical standpoint. We have had three or four such people with us recently. Indeed, at one time, the present minister of education for Hamburg spent two years at BASF on a training program."

Company scientists have the opportunity to attend a number of lectures throughout the year. There are, of course, general lectures, many arranged through local sections of the Gesellschaft Deutscher Chemiker. But there are also special lectures available to selected groups within the companies.

"Invitations are not limited to West Germans," Weissermel notes. "Speakers come from other countries, too. They represent a major cross section of prominent scientists. The object is to keep our people well informed on what's going on, to learn of others' research, get updated on new disciplines and new methods. But this is not specifically a Hoechst activity. It's the same for comparable companies like BASF and Bayer."

There is one activity in which BASF alone engages. This is an annual summer program for chemistry graduates. There are two three-week courses at the company's Ludwigshafen headquarters. Morning lectures are given by high-ranking company people. In the afternoons, there are visits to plants on the site.

Each program is open to 60 students. About half of them come from countries outside West Germany, in some instances from as far afield as such countries as Turkey and the Soviet Union.

"While here, they get detailed information about BASF," explains Pommer, who heartily endorses the program. "They learn not only about chemical problems, but about chemical engineering and financial and personnel matters. The aim isn't so much to hire future staff but to inform chemistry students in a very special way about the chemical industry.

"We are anxious to inform these people who later may become our partners either in other companies or in government positions. If they know about the work of the company, we hope they will understand it better," he says. □